be applied along ſide about midſhips in order to aſcertain the lee-way; which, if rightly ſhewn will give the ſhip's preciſe longitude. As to ſea-currents, this and all other machines hitherto invented, muſt be ſubject to their influence; and proper allowances muſt be made, according to the ſkill and knowledge of the navigator.

Laſtly, ſome diſcretion will be neceſſary in taking obſervations from the machine to be entered on the log-book. I mean, that the moſt favourable and equitable moment ſhould be choſen for the obſervation. Not whilſt the ſhip is rapidly deſcending the declivity of a wave; or is ſuddenly checked by a ſtroke of the ſea; or is in the very act of plunging. In all caſes, I ſuppoſe, periods may be found in which a ſhip proceeds with a true average velocity; to diſcover which a little experience and attention will lead the ſkilful mariner*

N° XII.

Account of an Electrical Eel, or the Torpedo of Surinam, by WILLIAM BRYANT, *Eſquire.*

SURINAM a colony of South America belonging to the ſtates of Holland, abounds with as many natural curioſities as any country in the world. But that which I look upon to be as ſurpriſing as any in it, and which I believe has not yet been accurately deſcribed, is a fiſh of the ſpecies of eel, and is caught there in nets among other fiſh; generally in muddy rivers, and I believe is found in moſt of the neighbouring provinces. In ſize and colour

* An ingenious mechanic would probably conſtruct this machine to better advantage in many reſpects. The author only meant to ſuggeſt the principle; experiment alone can point out the beſt method of applying it. He is ſenſible of at leaſt one deficiency, viz. That the little index R, figure 4, will not be ſtrong enough to retain the palate D in an oblique poſition when the ſhip is ſailing by the wind; more eſpecially as the compaſs plate S, in whoſe notched rim the index R is to fall, is not fixed to, but only fitted tight on the ſocket N. Many means however might be contrived to remedy this inconvenience.

colour it is not unlike a common eel of Europe or America, and in ſhape reſembles it more, except that it is thicker in proportion to its length, and the head is more flat and not ſo pointed; but differs from them in this reſpect, that it comes to the ſurface to breathe in the air. It is called by the Dutch *Beave Aal*, and by the Engliſh inhabitants the Numbing Eel. As to the other qualities, of which I mean chiefly to take notice, and which I think are as different from the Torpedo of Europe, as the fiſh is in ſhape, they are as follows.

On touching the fiſh as it lies in the water in a tub provided for it, a ſudden and violent ſhock is received, in all reſpects like that which is felt on touching the prime conductor, when charged with the electrical fluid from the globe; and like that chiefly, affects the ends of the fingers and elbow. Gently holding the tail of the fiſh with one hand and touching the head with the other, a very violent ſhock is felt in both elbows and through the breaſt and ſhoulders. I at firſt imagined that the violence of the ſhock proceeded from both arms receiving it at the ſame time, and that the pain was no more than that of the two ſtrokes added together; but I found myſelf miſtaken. For upon ſeven perſons joining hands, and the firſt taking hold of the tail (which may with more eaſe be held than the head) and the ſeventh at the ſame time touching the head, we were all affected in both elbows, and that in the ſame manner as I remember to have been in the electrical experiment, when ſeveral perſons take hold of the wire and the equilibrium is reſtored by the fluids paſſing through their bodies.

I find the ſhock may be received through metallic ſubſtances. On touching the fiſh with an old ſword blade I was ſtrongly affected. But arming it with ſealing-wax and taking hold of that part which was covered with it, the electrical fluid (I cannot help calling it ſo) would not paſs. Neither has it any effect on the body when touched with

glaſs bottle, ſealing-wax, &c. Yet I cannot obſerve the leaſt diminution of this quality by placing the tub which contains the fiſh on glaſs bottles; it continues the ſame in all reſpects. So that whether it has an unaccountable faculty of collecting a quantity of the fluid from the ſurrounding waters, or through the body of the perſon touching it, or has in its own body a large fund which it can diſcharge at pleaſure, I am greatly at a loſs to think or imagine.

Although it has no effect on the human body when touched with a piece of wood, or indeed any other ſubſtance not metallic; yet an accident diſcovered to me, that on ſome occaſions the effect would be ſenſible through wood. For one morning while I was ſtanding by, as a ſervant was emptying the tub, which he had lifted intirely from the ground, and was pouring off the water to renew it, and the fiſh left almoſt dry, the negro received ſo violent a ſhock as occaſioned him to let the tub fall, and calling another to his aſſiſtance, I cauſed them both to lift the tub free from the ground, when pouring off the remains of the water they both received ſmart ſhocks and were obliged to deſiſt from emptying the tub in that manner. This I afterwards tried myſelf and received the like ſhock. This fiſh indeed was one of the largeſt I have ſeen and but newly caught. For I obſerve that after being ſometime confined in a tub and wanting perhaps their natural food, they loſe much of the ſtrength of this extraordinary quality. I am ſometimes apt to conjecture, that this animal has the power of communicating the ſtroke when, and with what degree of force it will; and that it ſerves him as a weapon of defence againſt his enemies. For I have often obſerved that on firſt taking hold of it, the ſhock is tolerable; but as ſoon as he perceives himſelf the leaſt confined, it is much more violent. This I experienced to my coſt, as I one day took hold of it, about the middle of the fiſh, I lifted it partly out of the water, when on a ſudden I received ſo ſmart a ſhock

that

that it occaſioned a ſtrong contraction in the bending muſcles of my fingers, and I could not immediately let it go; but endeavouring to diſengage my hand threw it on the ground; taking hold of it a ſecond time, to return it into the tub, I was more ſtrongly affected than at firſt, and that not only in my hands and arms, but throughout my whole body; the forepart of my head and the back part of my legs ſuffered principally; and in the ſame manner as on receiving a very ſmart ſhock from a highly charged phial in electrical experiments.

On obſerving that the ſenſation occaſioned by the ſhock as to the nature and degree of ſtrength upon touching different parts of the fiſh, was different, I was at firſt inclined to think it might be owing to its having an extraordinary faculty of containing more of the fluid in one part of its body than in another. The tail part to above one third of its length, occaſions rather a numbneſs and tingling, than pain, but on applying the end of the fingers to the back, head, and under part of its body, it cauſes a ſharp pricking pain. This may poſſibly be accounted for by the difference in the texture of the ſurface of the ſkin, as the manner of the electrical fluids coming from a glaſs tube is different when its ſurface is altered by being rubbed with different ſubſtances, as has been lately taken notice of in a letter to the Royal Society.

Theſe are the principal obſervations, the ſhort time I reſided at Surinam, allowed me an opportunity of making relating to this extraordinary animal.

Obſervations